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Title: The type of spasticity predicts Botulinum toxin-A treatment outcome in children with cerebral palsy

Abstract text:

Research Question

Can the type of spasticity be used to predict the effect of treatment with Botulinum Toxin-A in the medial hamstrings?

Introduction

Our classical understanding of spasticity dictates that spasticity is velocity-dependent. However, data collected using an instrumented spasticity assessment has revealed position-dependent hyperactivity.[1] Intramuscularly injected Botulinum toxin-A (BTX) is effective in temporarily decreasing spasticity, although a large variability in response has been reported.[2] The aim of this study was to investigate whether the type of spasticity (velocity- or position-dependent) could predict the effect of BTX.

Materials and Methods

Eighteen medial hamstring muscles (n=14 children with CP; 10±2yrs; bilateral/unilateral involvement n=8/6; GMFCS I-III) were measured pre- and post-BTX. Kinematics and electromyography (EMG) were recorded during passive stretches across the full range of motion (ROM) at 3 velocities. Three equal position zones across the ROM were defined and average normalised root mean square EMG (rms-EMG) was calculated in each zone at each

velocity (Fig 1). Muscles measured pre-BTX were visually categorised as being either more velocity-dependent (VD) or more position-dependent (PD).[1] Average rms-EMG pre-BTX was compared across position zones during slow stretches (Pre $EMG_{slowP3-P1}$). The decrease in average rms-EMG post-BTX ($EMG_{PRE-POST}$) was compared between groups using Man-Whitney U tests and the relationship between Pre $EMG_{slowP3-P1}$ and $EMG_{PRE-POST}$ was investigated using Spearman rank correlation. Significance was set to $p<0.05$.

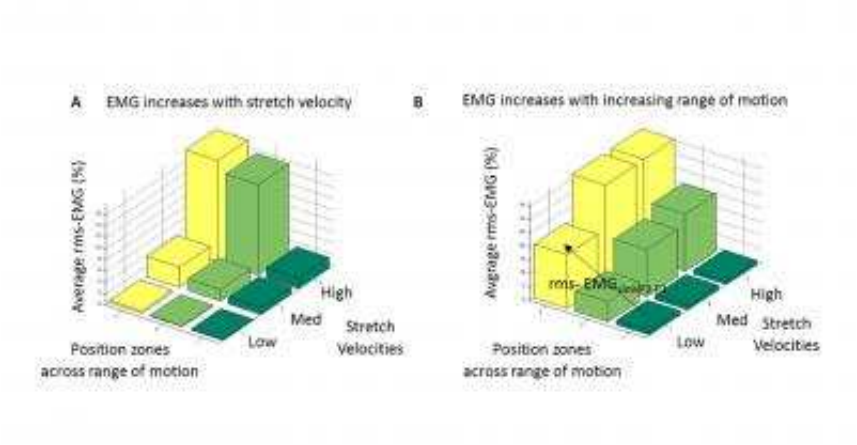

Fig 1. Example of (A) Velocity dependent and (B) Position dependent spasticity.

Results

$EMG_{PRE-POST}$ was significantly higher (p=0.01) in those muscles categorised pre-BTX as VD (Fig2A). There was a significant negative correlation between Pre $EMG_{slowP3-P1}$ and $EMG_{PRE-POST}$ (r=-0.63, $p<0.05$) indicating that muscles with more pre-BTX PD spasticity are less likely to respond to BTX.

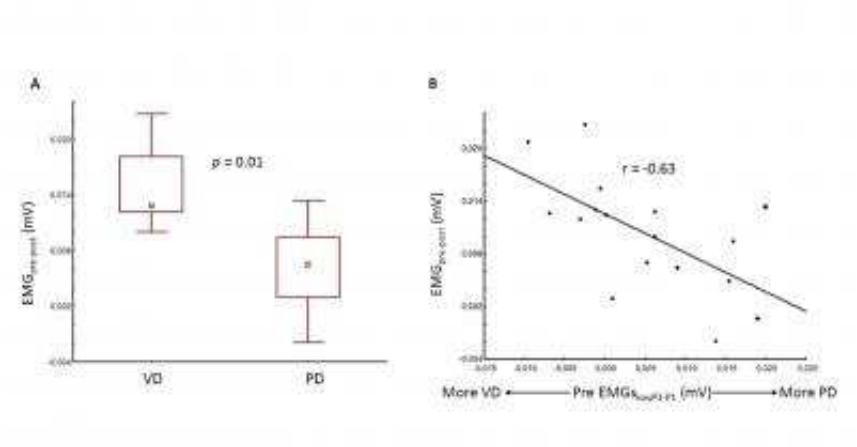

Fig. 2 (A) Change in EMG (EMGpre-post) in muscles categorised pre-BTX as velocity-dependent (VD) and as position-dependent (PD). (B) Correlation between EMGslowP3-P1 and EMGpre-post.

Discussion

VD spasticity in the medial hamstrings is an indicator of positive response to BTX. The predictive ability of spasticity patterns on outcome assessed by 3D gait analysis should be confirmed and the etiology behind the different patterns requires investigation.

References

1.Bar-On et al. PLoS One 2014;9:e91759.

2.Eames et al. Dev Med Child Neurol 1999;41:226-32.

Keywords: Spasticity, Cerebral Palsy, Botulinum Toxin A, Electromyography